

CLAIMS

1. A powder coating composition which comprises a film-forming polymer, a pigment providing a metallic effect, and a stabilising additive which, in a coating formed from the composition on a substrate, inhibits degradation of the metallic pigment in the presence of oxygen and water.
2. A powder coating composition as claimed in claim 1, wherein the metallic pigment is in flake form.
3. A powder coating composition as claimed in claim 1 or claim 2, wherein the metallic pigment comprises aluminium or an aluminium alloy, stainless steel, copper, tin, bronze or brass.
4. A powder coating composition as claimed in any one of claims 1 to 3, wherein the metallic pigment is incorporated in the composition by dry blending, preferably after milling.
5. A powder coating composition as claimed in claim 4, wherein the total proportion of metallic pigment(s) incorporated in the composition by dry blending is in the range of from 0.1 to 10% by weight, based on the weight of the composition without the metallic pigment(s), for example from 0.4 to 8% by weight, preferably from 0.1 to 5% by weight or from 1 to 4% by weight.
6. A powder coating composition as claimed in any one of claims 1 to 3, wherein the metallic pigment is incorporated in the composition before and/or during homogenisation, especially in the case of a low-shear homogenisation process, and the content of metallic pigment(s) incorporated is in the range of from 0.1 to 50% by weight, based on the total weight of the composition, preferably at least 5% or 10% by weight, advantageously not exceeding 30% by weight.
7. A powder coating composition as claimed in any one of claims 1 to 6, wherein the stabilising additive comprises at least one silicate material selected from the group consisting of:
- (a) materials obtainable by admixture or, preferably, reaction of silica or a silicate with a compound of a trivalent metal; and
- (b) naturally occurring or synthetic metal silicates.
8. A powder coating composition as claimed in claim 7, wherein the stabilising additive also includes an oxide selected from zinc oxide, magnesium oxide or silica, preferably zinc oxide.
9. A powder coating composition as claimed in claim 8, wherein the stabilising additive includes an amount of zinc oxide in the range

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of from 2 to 30% by weight, based on the total weight of the corrosion-inhibiting additive, advantageously at least 5%, 10% or 15% by weight, more especially not exceeding 20% or 25% by weight

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10. A powder coating composition as claimed in any one of claims 7 to 9, wherein the trivalent metal in embodiment (a) is chromium, iron or aluminium, especially aluminium.
11. A powder coating composition as claimed in any one of claims 7 to 9, wherein the silicate in embodiment (b) is a silicate of a trivalent metal, especially chromium, iron or aluminium, more especially aluminium.
- 10 12. A powder coating composition as claimed in any one of claims 7 to 10 in which the compound of a trivalent metal in embodiment (a) is a phosphate, fluoride, silicofluoride, chloride, sulphate or alkane carboxylate.
13. A powder coating composition as claimed in any one of claims 7 to 10 or 12, wherein the silica in embodiment (a) is amorphous silica or a precursor thereof.
- 15 14. A powder coating composition as claimed in any one of claims 7 to 13 wherein the stabilising additive, or a silica or silicate used in embodiment (a), is surface-modified by ion exchange.
15. A powder coating composition as claimed in claim 14, wherein the
- 20 ions involved in the surface modification are selected from calcium, zinc, cobalt, lead, strontium, lithium, barium and magnesium, especially calcium.
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16. A powder coating composition as claimed in claim 14 or claim 15, modified in that the stabilising additive comprises, or is derived from, silica or alumina which has been surface-modified as defined in those claims,
- 25 preferably in combination with zinc oxide.
17. A powder coating composition as claimed in any one of claims 7 to 16, wherein the ratio of silicon to metal atom is in the range of from 0.2 to 30 : 1, advantageously at least 0.5 : 1, 1.5 : 1, 2.5 : 1 or 3.5 : 1, preferably not exceeding 20 : 1, 15 : 1 or 10 : 1.
- 30 18. A powder coating composition as claimed in any one of claims 1 to 6, wherein the stabilising additive comprises a metal phosphate or a metal borate, the phosphate advantageously being an ortho-phosphate, hydrogen phosphate or polyphosphate, preferably an ortho-phosphate.
19. A powder coating composition as claimed in claim 18, wherein the
- 35 stabilising additive comprises zinc phosphate.

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20. A powder coating composition as claimed in claim 19, wherein the stabilising additive comprises zinc phosphate (preferably in spheroidal form) modified with zinc molybdate and rendered organophilic by suitable surface treatment.

5 21. A powder coating composition as claimed in claim 18, wherein the stabilising additive comprises dicalcium phosphate dihydrate.

22. A powder coating composition as claimed in claim 18, wherein the stabilising additive comprises dimagnesium phosphate trihydrate.

sub A<sub>4</sub> 10 23. A powder coating composition as claimed in any one of claims 1 to 6, wherein the stabilising additive has a content of stabilising anions, advantageous phosphate ions, capable of dissolving in the presence of water.

24. A powder coating composition as claimed in any one of claims 1 to 6, wherein the stabilising additive comprises an inorganic material.

15 25. A powder coating composition as claimed in claim 24, wherein the stabilising additive is substantially free of material containing organic moieties.

sub A<sub>5</sub> > 26. A powder coating composition as claimed in any one of claims 1 to 25, wherein the stabilising additive is incorporated by post-blending.

20 27. A powder coating composition as claimed in claim 26, wherein the proportion of stabilising additive(s) incorporated by post-blending is no more than 7.5% by weight, preferably no more than 5% or 6% by weight.

sub A<sub>6</sub> > 25 28. A powder coating composition as claimed in any one of claims 1 to 27, wherein the total content of metallic pigment(s) and/or other non-film-forming additive(s) incorporated by post-blending does not exceed 10% by weight, based on the weight of the composition without the pigment(s) and additive(s).

30 29. A powder coating composition as claimed in any one of claims 1 to 25, wherein the proportion of stabilising additive(s) incorporated before and/or during homogenisation of the composition is in the range of from 0.5 to 50% by weight, based on the total weight of the composition, for example at least 1%, 5% or 10% by weight and not exceeding 20%, 30% or 40% by weight.

35 30. A powder coating composition as claimed in any one of claims 1 to 29, wherein the particle size of the or each stabilising additive or component thereof is up to 25 microns, preferably no more than 10 microns, more especially from 2.5 to 7.5 microns.

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31. A powder coating composition as claimed in any one of claims 1 to 30, wherein the particle size of any zinc oxide included in the stabilising additive is in the range of from 0.1 to 10 microns.

32. A powder coating composition as claimed in any one of claims 1 to 31, which is a thermosetting system.

33. A powder coating composition as claimed in claim 32, which incorporates a film-forming polymer selected from carboxy-functional polyester-resins, hydroxy-functional polyester resins, epoxy resins, and functional acrylic resins.

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34. A powder coating composition as claimed in any one of claims 1 to 33, wherein the metallic pigment is a coated material.

35. A powder coating composition as claimed in claim 34, wherein the coating comprises silica or other inert inorganic material.

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36. A powder coating composition as claimed in claim 34, wherein the coating comprises a plastics material.

37. A powder coating composition as claimed in claim 34, wherein the metallic pigment is coated with a colouring agent.

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38. A powder coating composition as claimed in any one of claims 1 to 33, wherein the metallic pigment is carried in a polymer or plasticiser which is compatible with the film-forming polymer.

39. A powder coating composition as claimed in any one of claims 1 to 38, wherein the proportion of film-forming polymer (and curing agent where appropriate) is in the range of from 25 to 99.5% by weight, preferably from 40 to 98% by weight.

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40. A process for forming a coating on a substrate, in which a composition as claimed in any one of claims 1 to 39 is applied to the substrate by a powder coating process resulting in particles of the composition adhering to the substrate, and forming the adherent particles into a continuous coating over at least part of the substrate.

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41. A process as claimed in claim 40, wherein no further coating is applied to the coated substrate.

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42. A coated substrate obtained by a process as claimed in claim 40 or claim 41.

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43. A coated substrate as claimed in claim 42, wherein the substrate is a metal substrate.

44. A coated substrate as claimed in claim 42, which comprises a non-metallic material.

45. A coated substrate as claimed in claim 44, which comprises a plastics material, wood, a wood-based product, glass, glass fibre or a

5 composite, ceramic or textile material.

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